



Federal Dollars Available

Bolstering The Backbone Of The Natural Gas Industry

by Rodney Anderson, Product Manager, NETL, Natural Gas Infrastructure Reliability, Morgantown, WV

Every day, natural gas flows through nearly 2 million miles of pipeline to almost 60 million homes in the United States. Despite fear that recent accidents are not anomalies, but the forebearers of an increasing loss of safety and dependability, the gas transmission and delivery system has a remarkable safety and reliability record. While the amount of gas delivered has increased by 25 percent, the number of safety incidents has decreased by 38 percent over the past 10 years (American Gas Association, January 2000, America's Natural Gas Industry Has Safety Record That is a Model for the World).

But the U.S. natural gas infrastructure is aging, and it's aging as demand on the system is increasing. A 50 percent increase in gas consumption is predicted by 2020. The National Petroleum Council predicts that almost 40,000 miles of new gas transmission lines and almost 275,000 miles of distribution mains will be needed by 2015. Mix into this scenario the unprecedented changes occurring in the natural gas industry: deregulation, a rapid pace in mergers and acquisitions, pressure for financial performance, and a prediction that only modest price increases will be acceptable in the future.

The U.S. Department of Energy (DOE) has responded by proposing a new natural gas infrastructure reliability initiative in its fiscal year 2001 budget request to Congress. This research and development (R&D) program builds a collaboration with industry to ensure that the U.S. natural gas infrastructure remains dependable and stable. The program also includes a competitive solicitation to fund both private-sector R&D projects and national lab activities.

Resulting advanced technologies can assist the industry with infrastructure reliability, but the R&D implementers must demonstrate the value of the innovations. There is a general consensus that the natural gas industry is ultra conservative in adopting new technologies. Why? Because industry is reluctant to blemish their reliability record with new technologies that have unproven performance and unknown costs. To address this issue, the DOE initiative requires that R&D implementers team with manufacturers or representatives from the gas industry to help provide buy-in for innovations.



Rodney Anderson,
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The leading cause of accidents on distribution pipelines is excavators unintentionally striking our lines, commonly third-party damage. Year after year, these strikes cause over 60 percent of the total ruptures on utilities and the vast majority of injuries and fatalities. (Richard Reiten, President and CEO, Northwest Natural Gas, May 2000, written testimony presented before the U.S. Senate Committee on Commerce, Science, and Transportation Hearing on Pipeline Safety Reauthorization).



Flanked by West Virginia Sen. Robert Byrd and NETL Director Rita Bajura, Energy Secretary Bill Richardson signs the declaration naming NETL and the SCNG.

Strategic Center For Natural Gas

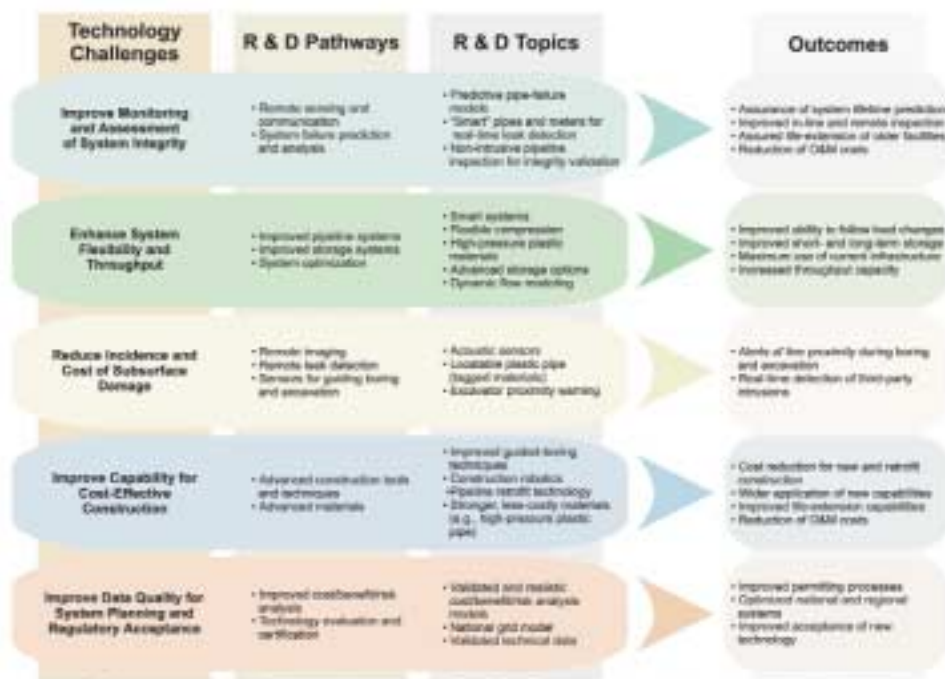
Until recently, government R&D on natural gas technologies was fragmented: undertaken by federal agencies working independently and often on similar projects without looking at the complete picture. This changed in December 1999 when Secretary of Energy Bill Richardson created the Strategic Center for Natural Gas (SCNG) at the newly designated National Energy Technology Laboratory (NETL).

The SCNG is a one-stop shop for federal programs in natural gas research and builds on NETL's foundation of 60 years of R&D in natural gas technologies. As Secretary Richardson decreed, the SCNG oversees the future of natural gas "from borehole to burner tip." It's the organization that understands the innovations needed to produce tomorrow's gas and knows how gas moves from the wellhead to the consumer. The Center coordinates federal activities on natural gas R&D, analysis and policy development to support the national strategy for natural gas. It combines the expertise of DOE, other government agencies, industry and the research community to ensure that the United States can meet future supply, transport and demand needs.

The SCNG is less than a year old and was only headlined as operational in May 2000. But the infrastructure team has already "hit the road running." The team sponsored two industry workshops in May and June 2000. Invited participants were senior executives and technical experts from the natural gas industry: representatives from pipeline companies, local distribution companies, integrated energy providers, industry-sponsored R&D groups, industry associations and government organizations. They examined the issues associated with operational reliability and integrity of the natural gas infrastructure and identified opportunities for technology development that could resolve these issues.

Infrastructure Roadmap

The final report on the workshops outlines the infrastructure roadmap—



Technology Roadmap for Infrastructure Reliability (from Pathways for Enhanced Integrity, Reliability and Deliverability).

the SCNG framework for ensuring that the natural gas infrastructure remains stable and dependable. Pathways for Enhanced Integrity, Reliability, and Deliverability is available at www.netl.doe.gov/scng. This report reflects the gas industry's outlook on the trends and drivers impacting the infrastructure. For example, the infrastructure market will grow significantly, but the industry will be quite different: the types of customers, the specific services, and delivery patterns will all change. Deregulation and industry restructuring have altered decades-old patterns, and policy changes have not kept up with a rapidly changing industry. Technology development patterns have lagged behind the market changes, and the focus on longer-term, public-benefits R&D is eroding. And finally, ensuring environmental quality and preserving system integrity crosscuts all concerns.

The vision for the nation's infrastructure reflects two primary drivers: (1) the need to provide the desired services while meeting the expectations of customers and the general public, and (2) the need for pricing that reflects the emerging trend toward value-added services and products rather than mere delivery of a commodity. But the industry recognizes it must become proactive and progressive to achieve the vision and identified seven aggressive goals at the workshops:

1. Increase pipeline capacity by 10 percent without changing the infrastructure.
2. Improve the flexibility of the system to respond to load changes.
3. Reduce safety incidents by 50 percent by 2010.

4. Devise a technology to assess system integrity and trade-offs by 2005.
5. Establish electronic systems to enable seasonal, daily, and hourly delivery by 2005.
6. Develop a portfolio of technologies to reduce construction, operation, and management costs by 2005 to 2010.
7. Decrease the rate of air emissions by 50 percent by 2010.

A major technology challenge is life extension and efficient use of the current infrastructure, and some of the technology needed to meet this challenge crosscuts possible solutions. Advanced remote sensing would improve the detection of underground facilities, in-pipe inspection and monitoring, and the sensing of proximity to underground facilities. Smart systems—pipes that have sensors to relay specific data—would make the timely detection, monitoring, and repair of outside or third-party infringements and damage feasible, and could include self-monitoring and repair.

Industry participants listed the types of R&D needed by year and then categorized the topics as low, medium or high priority. High-priority R&D topics are listed here.

Near-Term (0 to 3 years)

- Technology to locate and image underground facilities from aboveground.
- Advanced in-line inspection tools.
- Lower-cost emission systems for compressors.
- Optical methane and ethane detectors.
- Locatable plastic pipe and detection of non-metallic pipe.

- Technology evaluation and certification methodology.

Mid-Term (3 to 7 years)

- Three-dimensional imaging of facilities from aboveground.
- Advanced tools and methods for integrity assessment.
- Sensors and warning systems on excavation equipment.
- Advanced, high-pressure composite materials.
- Advanced directional drilling.
- Enhanced leak detection and communication.

Long-Term (7+ years)

- Intrusion detection and communication.
- Smart systems with multi-functional sensing (residual life, third-party damage), control-system communication and rapid-response system control.

One conclusion from the workshops is that the challenge for the industry is twofold: (1) finding collaborations among government, industry, and research organizations that build upon current successes; and (2) defining new opportunities for maintaining and enhancing the integrity, reliability, and deliverability of the nation's natural gas infrastructure.

Infrastructure Reliability Solicitation

The SCNG used the roadmapping results as a framework for a new DOE program to develop innovative technologies that could strengthen the reliability of the U.S. gas distribution and transmission systems. This program marks the first time that DOE has included funding for natural gas infrastructure research in its annual budget request. The solicitation Infrastructure Reliability for Natural Gas was released in early November 2000 and is available at www.netl.doe.gov/scng. *Note: proposals are due by Jan. 9, 2001.*

DOE is requesting proposals that support technology developments in natural gas transmission, distribution or both. Applicants are encouraged to submit proposals for research and development efforts on:

- Technologies to detect or alleviate third-party damage, such as sensors, pipeline materials, coatings and communication techniques to detect infringements and potential infringements on natural gas transmission and distribution pipelines.
- Technologies to locate and/or detect subsurface facilities, such as non-metallic pipes.
- Improved, cost-effective technologies to detect pipeline leaks.

(From Pathways for Enhanced Integrity, Reliability and Deliverability)

The Vision: The gas infrastructure of the future will provide customer-specific service in a safe, reliable, environmentally benign, and efficient manner—at prices that are commensurate with the value provided.

- Improved technologies for internal and external inspection of pipes, such as new and improved sensors, monitors and metering devices, and new "smart pig" technology.
- Improved guided boring technologies for underground directional drilling and advanced trenching technologies.
- Improved technologies or tools for pipe inspection and repair, to evaluate pipeline integrity and to repair pipe while minimizing excavation.
- Materials with increased corrosion resistance and the ability to operate at higher pressures, such as new pipe material and liners for existing pipes, or smart pipes that could be self-healing or self-monitoring.
- Improved compressors that are more cost-efficient, require less maintenance, reduce fuel consumption, optimize operation and are capable of flexible operation.
- Improved automated data acquisition, system monitoring, and control techniques between the field and control centers.

DOE anticipates that technologies or methodologies that are successfully developed under this solicitation will be commercialized for use by, or incorporated into, the natural gas transmission and distribution infrastructure. DOE expects to provide up to about \$10 million to support work under this solicitation. Multiple projects will be awarded for periods up to three years, with the maximum awards being about \$1 million, including a minimum 35 percent

cost share by applicants. DOE strongly encourages teaming arrangements, and applicant teams must include, at a minimum, a technology developer and a manufacturer or implementer of the technology or methodology.

A small team of government and industry experts has been assembled to review the proposals and to make recommendations for funding. As a beginning to coordination between DOE and the Department of Transportation (DOT), a representative from the Office of Pipeline Safety in the DOT will participate in the reviews. Following selection of projects by DOE, a peer review team will be assembled, again composed of government and industry representatives. This team will meet regularly to evaluate the progress of projects as well as their relevance.

Bolstering The Backbone

Success in bolstering the backbone of the natural gas industry—maintaining and improving infrastructure reliability and integrity—rests on collaboration: cooperation among government and academic researchers and industry stakeholders. Industry groups note that the gas infrastructure needs accelerated development and they need help in reducing regulatory barriers. Furthermore, industry feels that the government needs to take a strong role in bringing the different groups together, to making the collaboration work.

One of the federal government's prime business strategies today is being fiscally

As funds for technology development become harder to find, it's vital that government and industry R&D programs be well focused and well coordinated. We believe it's especially important that government initiatives on pipeline safety be developed and carried out 'arm-in-arm' with the pipeline industry's safety experts. (John Riordan, President and CEO of the Gas Technology Institute, June 2000, Third Annual North American Safety Summit).

NETL has a history of working with industry to address issues that directly benefit the public. This new natural gas infrastructure initiative means that our programs now span the range from exploration and production, through infrastructure, to utilization - including advanced turbines, fuel cells, and distributed generation. (Joseph P. Strakey, Director, Strategic Center for Natural Gas at NETL).

responsible, and this means that the public must benefit from public funds spent on research—and the benefits must be obvious to the public. The needed infrastructure R&D will result in environmental, safety and energy security public benefits. The solicitation offers government funding for research to ensure that Americans have the natural gas they need, safely, and when they need it, without harming the environment. The gas infrastructure of tomorrow will be safer, cleaner and even more reliable. Through the use of new technologies, we believe this can all be accomplished at reduced costs to the consumer.

Collaboration and co-funding among industry groups and research organizations will ensure that dollars are leveraged in an effective manner and that duplication of efforts is avoided. Dave Parker, president and CEO of the AGA, says, "Small wonder that our pride in our hard-earned reputation for safe, reliable delivery is matched only by our commitment to constantly improving our delivery system." This solicitation is a joint government/industry start toward that improvement. **P&GJ**



Rodney Anderson (left) and Dan Driscoll discuss potential damage to a natural gas pipeline from third-party infringement. Driscoll is a project manager and Anderson is the product manager of the NETL Natural Gas Infrastructure Reliability product team.